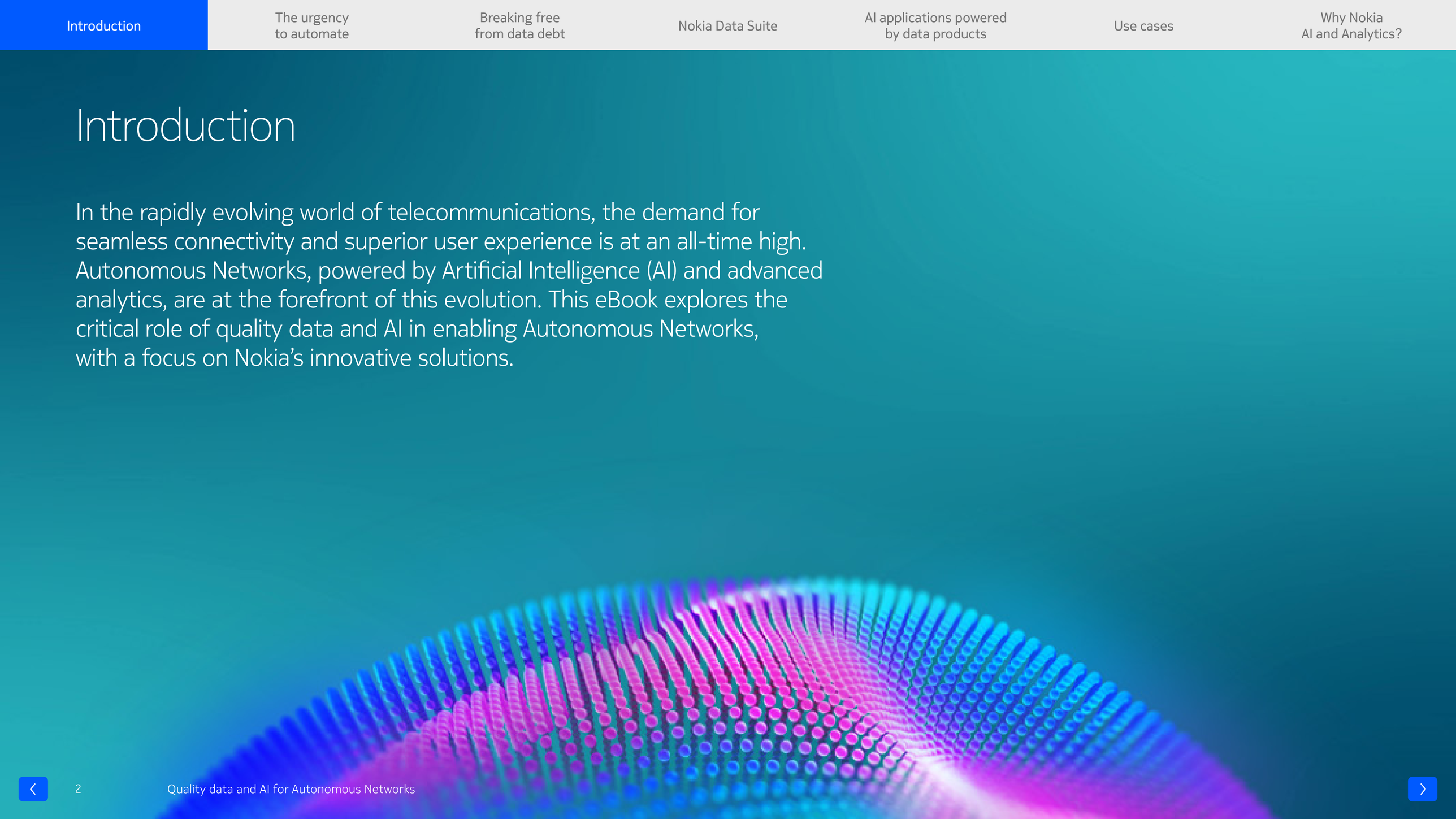
eBook

Nokia AI and Analytics

Quality data and AI for Autonomous Networks

Introduction

In the rapidly evolving world of telecommunications, the demand for seamless connectivity and superior user experience is at an all-time high. Autonomous Networks, powered by Artificial Intelligence (AI) and advanced analytics, are at the forefront of this evolution. This eBook explores the critical role of quality data and AI in enabling Autonomous Networks, with a focus on Nokia's innovative solutions.



The urgency to automate

Autonomous Networks represent the next generation of network management, where AI-driven automation and analytics enable self-optimizing, self-healing, and self-managing capabilities. These networks are designed to handle the increasing complexity and scale of modern telecommunications, ensuring efficient and reliable service delivery.

Using the TM Forum's Autonomous Network Maturity Model (Levels 0-5) as a benchmark, moving closer to Level 5 benefits telcos of all sizes. For example, research from STL Partners shows that autonomous networks can deliver an average CSP a yearly benefit of $800M, split across $300M in CAPEX savings, $350M in OPEX savings, and $144M in revenue uplift from faster, more profitable services. Notably, reaching Levels 4/5 unlocks 30% of that opportunity. The path each CSP will take toward fully autonomous networks will be unique to its own environment, but a couple of things are clear: the need to automate is urgent, and the pace must accelerate.

(TM Forum's latest Autonomous Networks study also says that more than 60 CSPs have already signed their AN Manifesto, agreeing to work towards Level 4.)

AI, especially Agentic AI, offers great potential for Automation. By 2028, AIOps is expected to account for 26% of CSP automation investments, according to Appledore. With AI-enabled use cases, operators can optimize network performance, reduce downtime, and enhance customer experience. The emergence of agentic AI systems takes this a step further, as these systems can proactively act, adapt, and optimize without constant human intervention.

In its latest Agentic AI report, Appledore states that a key aspect of agentic AI is its ability to interact with a variety of data sources in real time. In operations, real-time access to quality data empowers service providers to proactively detect network and security issues before they escalate. Furthermore, Appledore estimates that the Agentic AI market will grow to 6.2 billion by 2030.

Yet the industry's capabilities to harness AI for advancing automation still have room to improve by 2025. TM Forum's study also reveals that a lack of a data strategy was rated as one of the biggest challenges to reaching fully autonomous networks (considered serious or somewhat of a challenge by three-quarters of respondents). The need to automate as well as the need for a data strategy and culture of data democratization are clear. A multi-vendor, multi-domain, quality data foundation is a fundamental part of utilizing AI for Autonomous Networks.

$6.2B

Agentic AI market in 2030

#1

Access to high-quality data ranked as top AI adoption barrier

*1 An average CSP is defined as having revenue of US$15.6 billion, EBITDA of US$8.3 billion, 31 million mobile subscribers, and 12 million fixed subscribers. A CSP with larger metrics could potentially expect larger financial benefits.

*Agentic AI - Role of Agentic AI in Telecommunications Appledore research 2025

*Source: Analysys Mason 2023, TM Forum 2024, and Omdia 2025

Breaking free from data debt - how data mesh fuels Autonomous Networks

CSPs face a significant obstacle: data debt. This silent, yet major issue often undermines their ability to fully harness AI's capabilities for automation.

Data debt refers to the accumulation of poor-quality, siloed, and unstandardized data within an operator's operations. It occurs when poor data management leads to long-term challenges. This issue is exacerbated by the sheer volume of data generated daily - from multi-vendor network operations and customer interactions to usage patterns and real-time performance metrics.

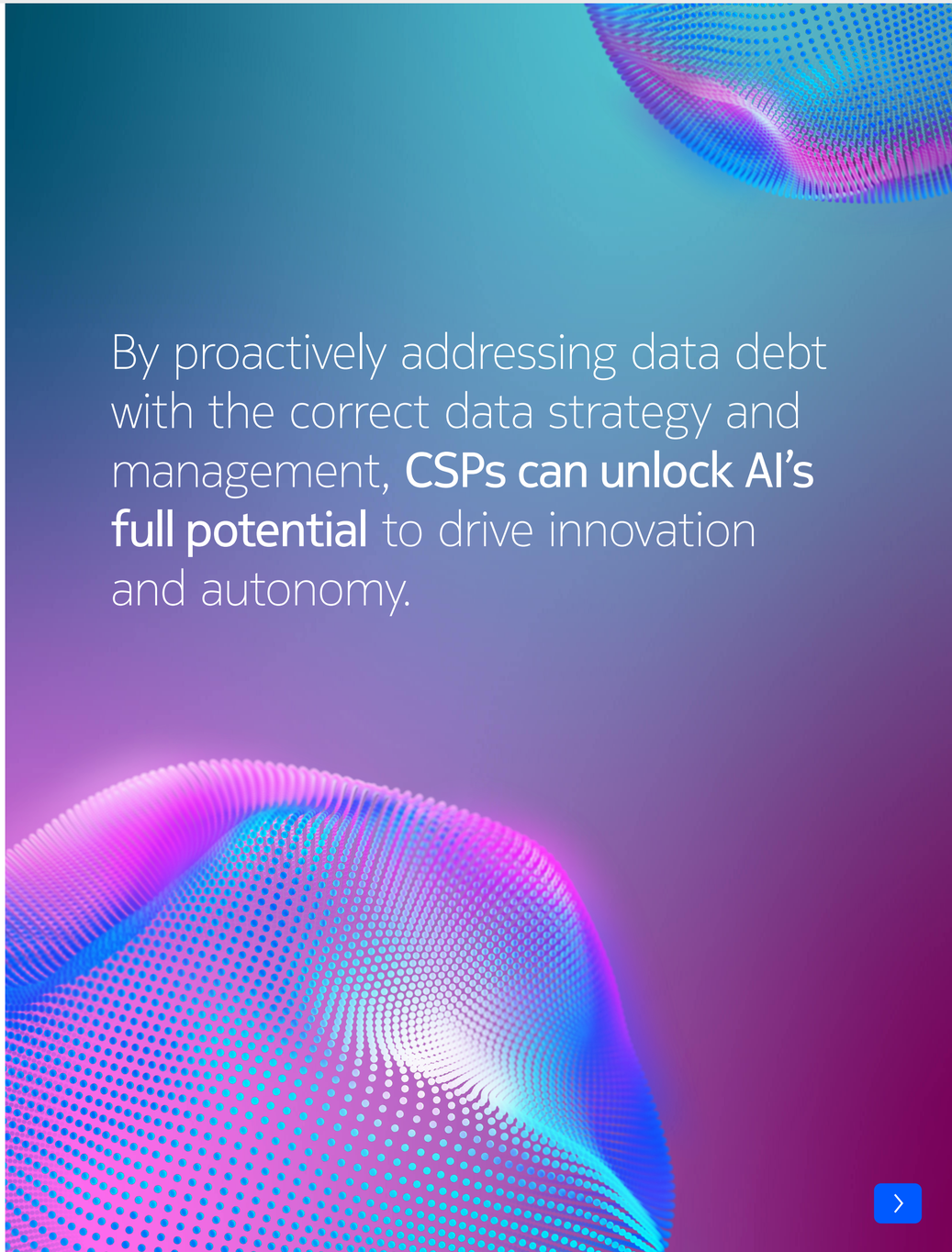
Data debt can manifest in various ways. Networks often rely on disparate systems from multiple vendors which creates siloed and fragmented datasets across network domains such as Radio Access Networks (RAN), core, and transport. These fragmented datasets are challenging to integrate or correlate. Additionally, legacy infrastructure often lacks modern data management capabilities, further contributing to data debt. The shift to 5G and the rise of IoT and edge computing have dramatically increased the variety and velocity of data, compounding the issue. Moreover, the absence of robust data governance frameworks results in data quality issues like duplication, corruption, outdated information, and security concerns.

The consequences of data debt are substantial:

- AI systems depend on high-quality data to train models, and data debt leads to gaps and inaccuracies that compromise the effectiveness of AI algorithms.
- Data debt extends the time required to prepare datasets for AI projects, with CSPs' data scientists spending up to 80% of their time preparing data instead of innovating AI use cases, according to Analysys Mason.
- The resources needed to address data debt, whether through manual intervention or implementing data pipelines, add to the costs of AI development.
- Data debt restricts the scalability of AI projects by making it difficult to integrate new data sources or expand the system to accommodate additional use cases.
- Poor data management practices may also lead to regulatory non-compliance, particularly in regions with stringent data protection laws like GDPR, posing risks related to security and compliance.

To address data debt, CSPs must prioritize modern data management practices:

- Adopt data mesh architecture with data products: Data mesh is a paradigm shift in data architecture that decentralizes data ownership and management. Instead of a centralized data team, domain-specific teams take responsibility for their data as a product. This approach aligns well with the needs of CSPs, where data is generated across various domains such as RAN, core, transport, customer interactions, and more. By decentralizing data ownership and creating domain-specific data products, CSPs can ensure data is well-governed, standardized, and ready for AI use.
- Implement an underlying data fabric layer: Data fabric technologies provide the tools to integrate, clean, and standardize data across silos, creating a unified and accessible data foundation. A data fabric is an architecture that provides a unified layer for data management, enabling seamless access, integration, and governance across disparate data sources and systems. This architecture connects data from silos, ensuring real-time availability and providing consistent and secure access to data, regardless of where it resides - be it on-premises, in the cloud, or at the network edge.
- Invest in data governance frameworks: Establishing policies for data quality, security, and access ensures a consistent and reliable data pipeline for AI applications. A data management platform should have robust governance capabilities, including data observability, data lineage, metadata management, and access management. Data observability is needed to track and assess the health of the data and find anomalies or inconsistencies. Data lineage features allow CSPs to track the origin and transformation of data, ensuring transparency and accountability. Access management capabilities, such as a data catalog, ensure that data is accessible to authorized personnel while maintaining stringent security protocols. These governance frameworks help CSPs build a consistent and reliable data pipeline, supporting AI applications and compliance with regulatory requirements.
- Foster cross-functional collaboration and data democratization: Encouraging collaboration between IT, network teams, and business units is vital for shared responsibility in data quality and usability. By bridging the gap between different departments, CSPs can foster a culture of collaboration where data is treated as a shared asset. This approach ensures that data quality is maintained across the organization and enhances the usability of data for various AI-driven use cases.



Data mesh and data products explained

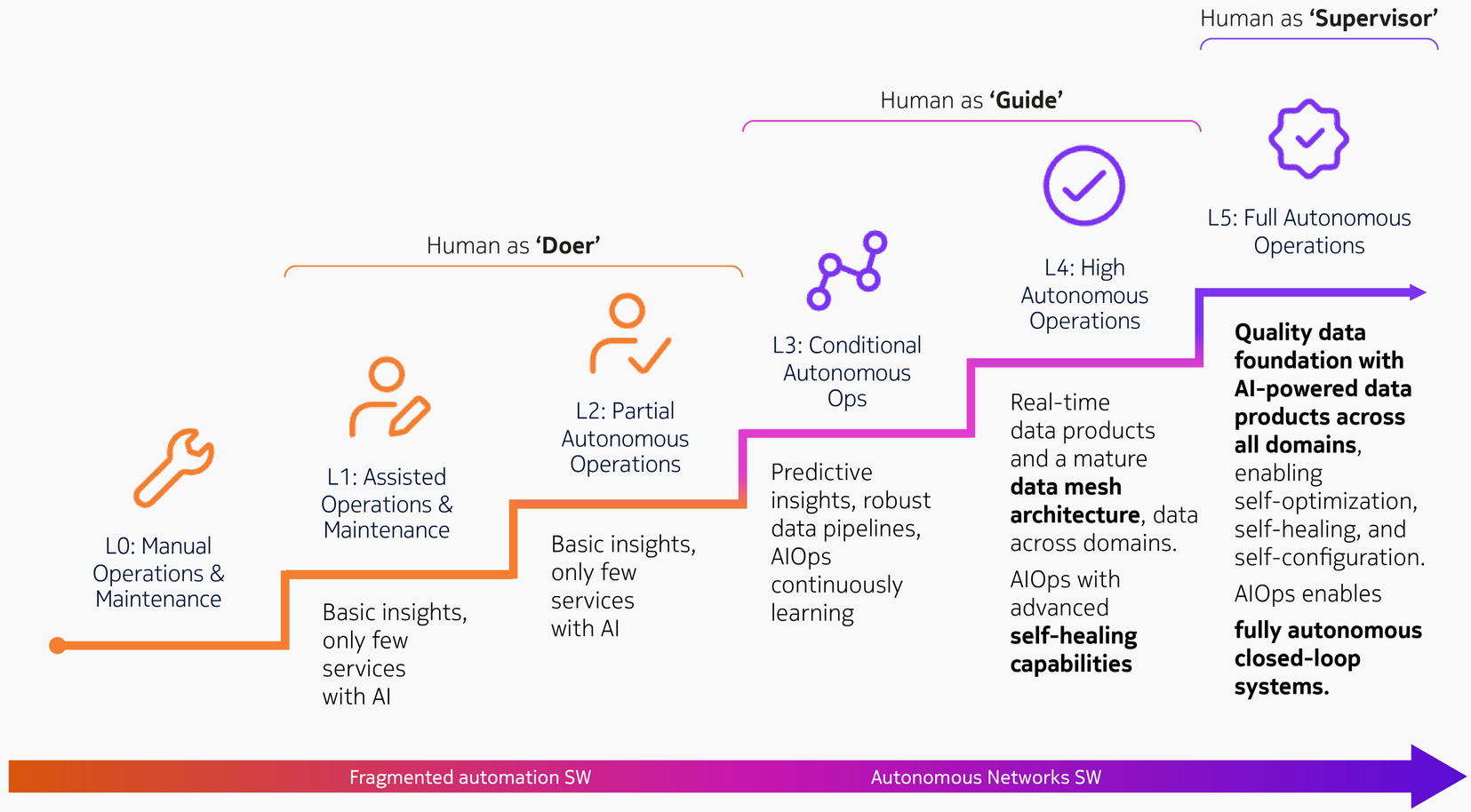
Traditional big data systems entail moving raw data from multiple sources into a large, monolithic data lake or data warehouse. Data mesh fundamentally differs from this approach - instead of consolidating data into a monolith, it relies on data federation and data abstraction to virtually combine data, called data products, from dispersed sources for increased agility. Data products and the concept of a data mesh are closely related in the context of modern data management and data-driven organizations. Both are centred around the idea of decentralization and scalability in managing and utilizing data. Data products are specific implementations within the holistic data mesh approach, representing individual data offerings created by domain-specific data teams or product teams. Data products are designed to serve specific users or business needs, providing data in a consumable and meaningful way. Both concepts aim to democratize data within organizations, making it accessible to a broader range of users and teams.
Data products are a means of achieving this democratization by providing valuable data in a self-service manner.

Data products transform raw data into usable assets

Data products provide a perfect data foundation (real-time, high-quality, and federated across domains) that ensures AIOps powers at maximum efficiency for a level 5 of autonomy. At this level, the network operates entirely without human intervention, using AI to adapt to changing conditions and continuously optimize performance. These data products integrate edge and central data to make near-instant decisions. Having complete access to network, customer, and operational data across all levels allows CSPs to break silos and create interoperable systems that can scale automation.

Modern data architecture with data products plays an integral role in enabling CSPs to transition from manual operations to fully autonomous, AI-driven networks.

Quality data foundation for Autonomous Networks



Create the quality data foundation for Autonomous Networks: Nokia Data Suite

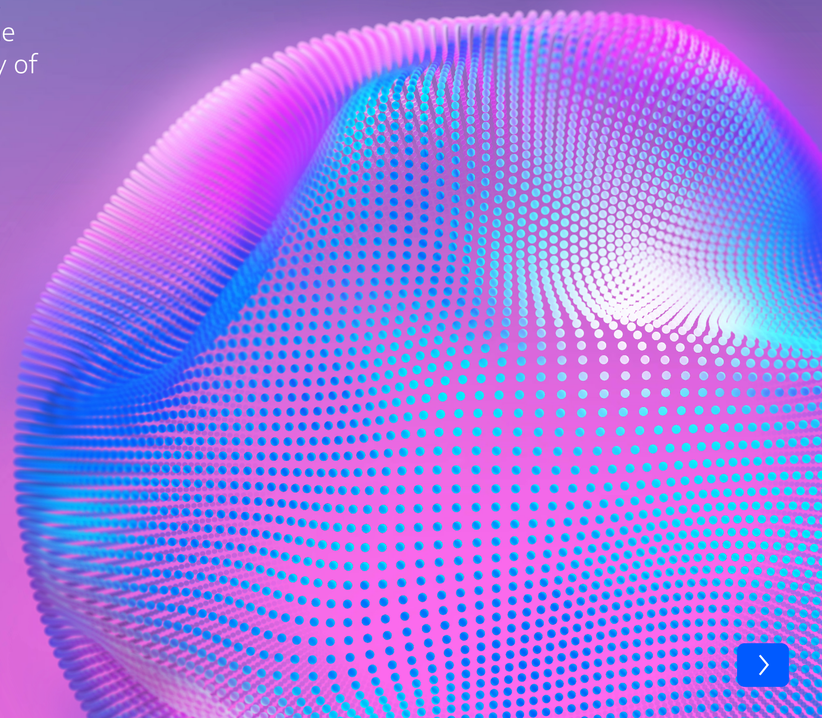
Nokia Data Suite is designed to address telecommunications data challenges by leveraging Nokia's extensive expertise in the field. As the No. 1 provider in the Network Automation Software segment for 2023, according to Appledore Research*, Nokia brings years of experience and a wealth of AI use cases in telco networks to the table. This expertise is further enhanced through intensive research on AI/ML in collaboration with Bell Labs.

The cloud-native Nokia Data Suite empowers CSPs by integrating expertly curated telecom data products with an intuitive drag-and-drop interface, including pre-packaged AI models, for CSP employees to build BI, AI or GenAI use cases. This platform accelerates the development of AI use cases, with even up to 70% faster the Machine Learning Operations (MLOps) lifecycle - paving the way for Autonomous Networks.

Nokia Data Suite offers standardized and ready-to-use data products that transform raw data into advanced and cognitive assets by incorporating domain knowledge and intelligence. The data products are built by ingesting and automatically correlating data from multiple data sources across multi-vendor, multi-domain networks, leading up to **potential savings of millions in data management.** This is made possible through our advanced multi-vendor data intelligence engines, an extensive library of automated data transformation services, and cutting-edge data mesh capabilities. This streamlined process empowers CSP's data scientists to swiftly develop and deploy new AI/ML applications based on the unified data model while eliminating the time to adapt to different vendor-specific data sources & data fields.

These reusable data products provide high-value actionable insights to drive customer business objectives, such as automating operational workflows, improving quality of experience (QoE), reducing energy consumption, and optimizing network performance. They offer a comprehensive end-to-end view of subscriber experience and network observability and enable the drive towards network autonomy.

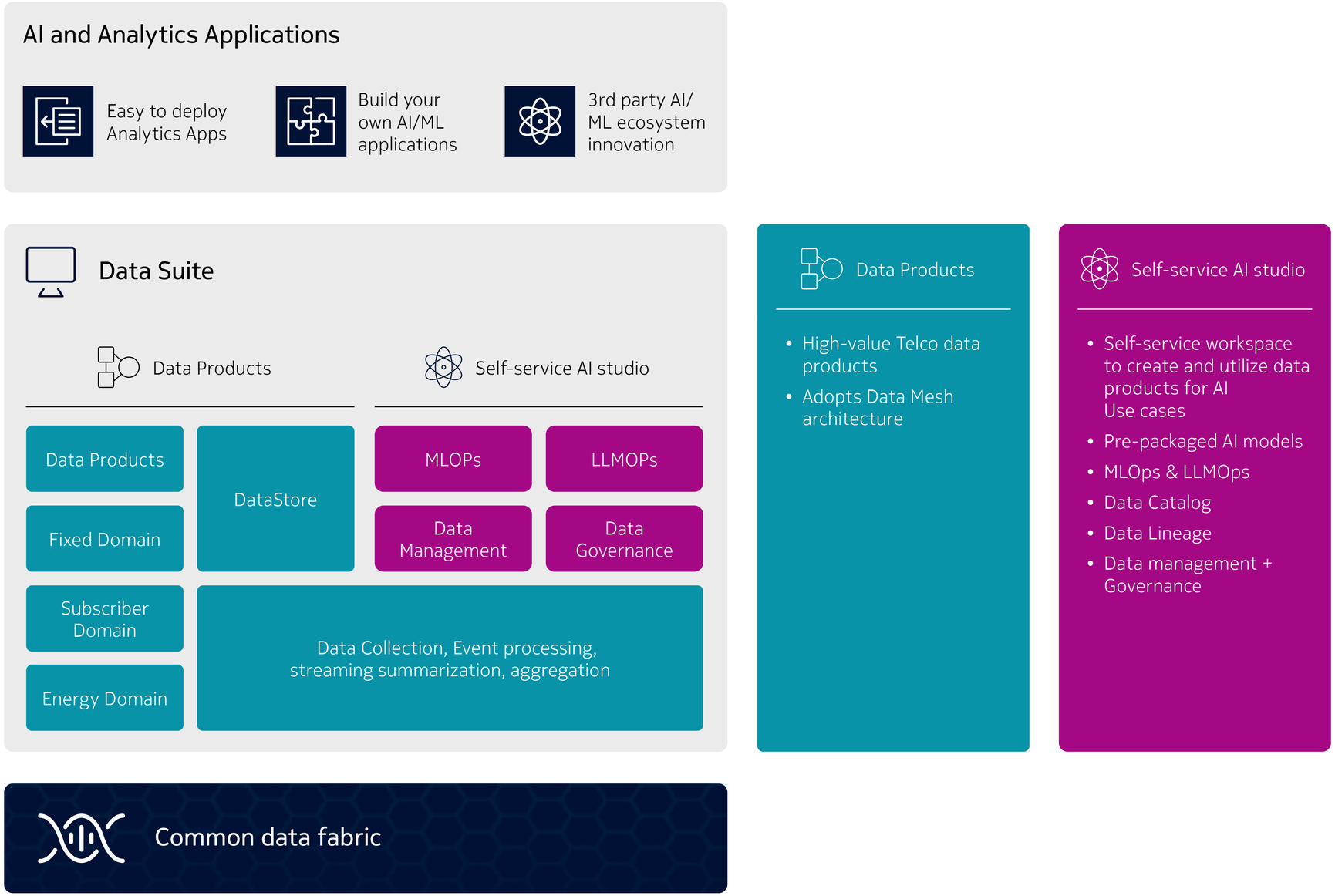
Nokia Data Suite also allows users to create their own data products through the AI Studio from existing data products or external data sources and publish them for external consumers. The data products can be published through a data catalog for external access using outbound APIs. The output of the data products may include root cause analysis (RCA) or next best actions (NBA) from AI models, which can be shared with an external orchestration engine for consumption. This enables closed-loop actions on the network, contributing to the autonomy of network operations.



Nokia Data Suite also offers the crucial components for explainable AI, including **end-to-end data observability, robust data governance, and security mechanisms** throughout the data product lifecycle, ensuring data accessibility, reliability, and security. Data validity is checked using rules, metrics, and schemas to ensure data meets standards and logical consistency. The platform's data lineage functionality automatically tracks data's technical transformation, offering complete transparency into its journey and changes. Complementing this, the data catalog feature enforces effective access management, ensuring that data is only available to authorized personnel. These governance capabilities empower CSPs to create a consistent and trustworthy data pipeline.

Designed to be cloud-agnostic, Data Suite seamlessly integrates with any existing ecosystems and environments. **Together with any hyperscaler toolchains, Data Suite's data products provide CSPs with a powerful, scalable solution to build BI, AI, and Agentic AI systems.**

Nokia Data Suite is part of Nokia Autonomous Networks applications, which are powered by the Nokia Autonomous Networks Fabric, providing seamless data integration, automation, and security across all network domains, including core, mobile, and transport.



AI applications powered by data products – solving CSPs' business problems

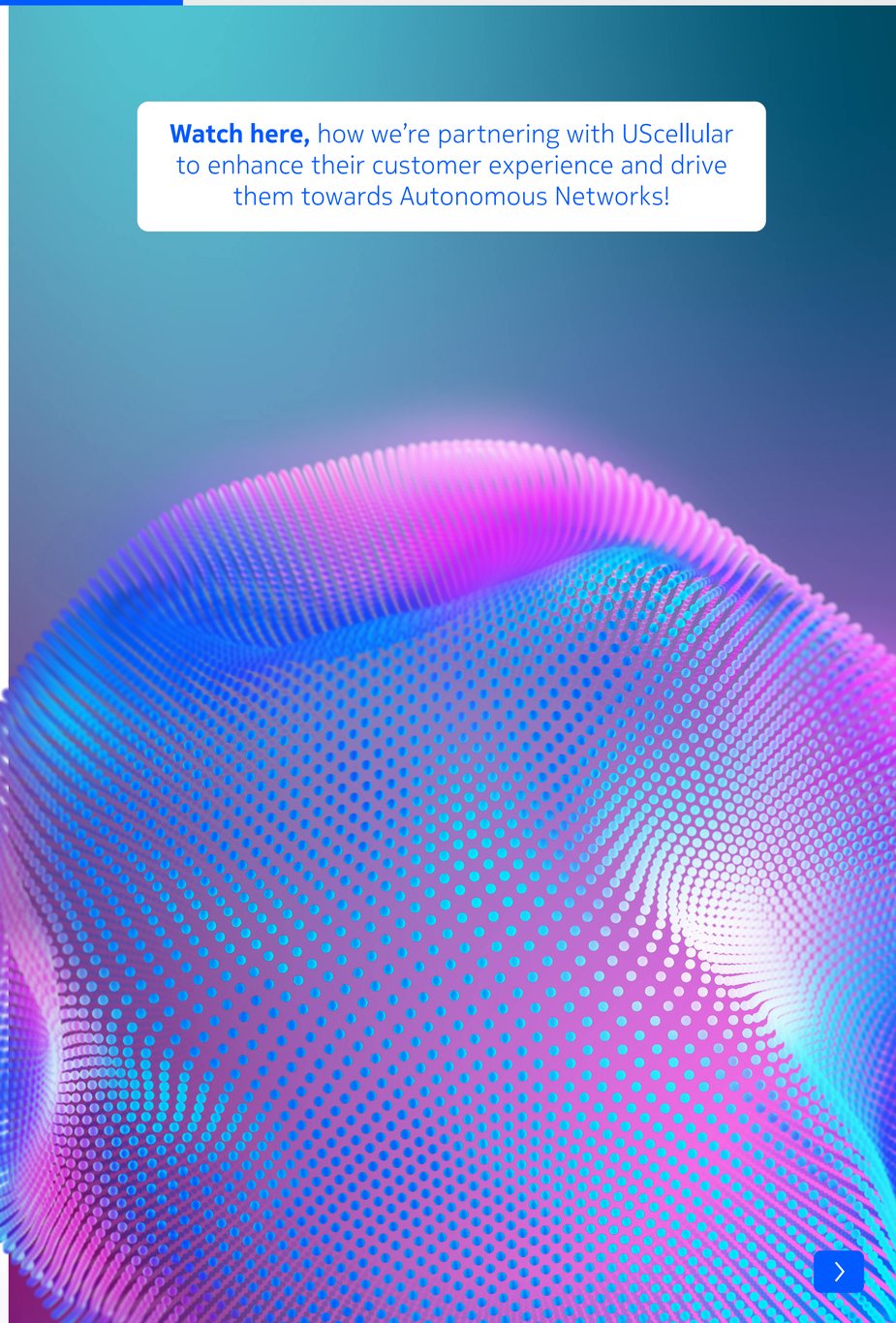
There are multiple drivers for CSPs to get closer to fully Autonomous Networks, including improving customer experience, simplifying operations and reducing costs. To meet these business goals, CSPs can, with the help of Nokia Data Suite, build their own AI use cases, even Agentic AI systems, or utilize Nokia's range of cloud-native off-the-shelf AI applications.

Nokia employs a consistent approach by leveraging Nokia's Data Suite's standardized data models, including in Nokia's AI applications. This involves initially gathering the requisite data tailored to the specific use case, followed by conducting unsupervised anomaly detection and root cause analysis. Then we're able to provide tailored proactive recommendations for mobile and fixed networks to achieve each use case's defined objectives in real-time, facilitating the move towards autonomous operations.

Example use cases our AI and GenAI solutions enable, for both mobile and fixed networks:

- Churn reduction: Strategically minimize churn rates and identify revenue enhancement opportunities by accurately predicting churn instances based on historical data. This proactive approach empowers CSPs to intervene before churn occurs, ensuring sustained customer retention and maximizing Customer Lifetime Value (CLV).
- Quality of Experience (QoE) improvements (Voice/Video/Gaming/Streaming): Elevate the QoE for end users across various applications and services. By analyzing app events and metrics, our solution identifies areas for improvement, prescribing the next best actions to enhance QoE and rectify network issues promptly.
- Expenditure reduction (preventing network issues or customer care tickets): Employ AI-based analysis to detect recurring patterns and facilitate early intervention on network issues. CSPs can proactively mitigate potential disruptions through incident grouping and root cause identification based on spatial and temporal proximity, thereby reducing operational costs.
- Energy savings: Through intelligent algorithms embedded in our data products, we minimize power consumption in the RAN, including active elements and passive equipment such as air conditioning units. Rigorous mechanisms continuously monitor network performance and ensure no negative impacts on customer experience. Our software saves energy based on factors such as time, location, configuration, and usage, enabling CSPs to reduce their carbon footprint by up to 30%.

Watch here, how we're partnering with UScellular to enhance their customer experience and drive them towards Autonomous Networks!



China Mobile drives Autonomous Networks with Nokia's Agentic AI

Act

Agentic AI systems:
- Fault dispatching
- Customer care
- Knowledge acquisition

vLLM Framework for AI Inference Acceleration

AI-driven self-service automation

Think

AI Orchestration with Gen AI and traditional AI

Open and secure Agentic AI Framework

LLM agent technology

Sense

Network logs and data integration

Localized knowledge centers

Knowledge libraries

Customer challenge

中国移动 China Mobile

- Legacy operational processes
- Manual processes
- Integration Complexity

Business results

27% reduction in fault dispatching tasks

Multi-Million Annual savings in network operations

19% decrease in system recovery time

16% reduction in complaint handling tickets

Multi-million savings in data management for Tier 1 NAM CSP

Act

- Network Engineering teams
- Network Operations
- Customer Services teams

Think

- Data visualizations
- Data correlation at a scale
- 270K reports per second

Sense

- Large-scale data collection from 250k cells
- Simplified observability

NOKIA, CORNING, SAMSUNG, ERICSSON, casa systems

Customer challenge

Multi-vendor event data stitching manually

Business results

Up to 30 million savings in data management

Vendor agnostic data collection and 3GPP standardized reporting from **250k cells - 270k report per second**

Reduced lead time to integrate a new vendor into the RAN domain

One stop for all data.
No complicated connections to individual NEs

Why Nokia AI and Analytics?

Nokia AI and Analytics software are proven to help CSPs boost productivity, enhance telecom customer satisfaction and reputation, and grow new revenues. Over 150 CSPs globally rely on Nokia AI and Analytics solutions to unlock the intelligence in their 5G, 4G and fixed broadband networks.

Read more about **AI and Analytics solutions**.

Abbreviations:

AI=Artificial intelligence

CSP=Communications service provider

GenAI=Generative AI

LLM=Large language models

ML = Machine Learning

QoE = Quality of Experience

RAN = Radio access network

MLOps= Machine Learning Operations

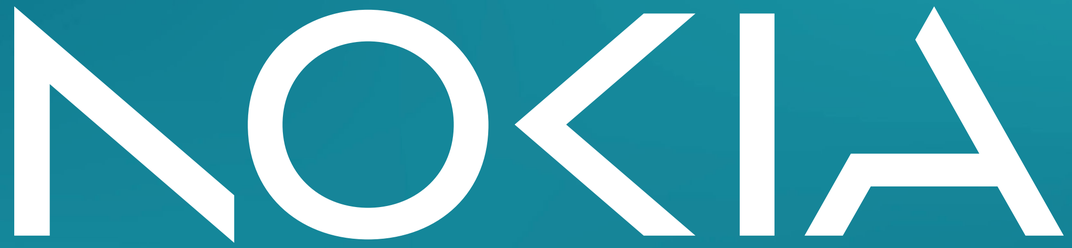
LLMOps= Large Language Models Operations

Nokia OYJ
Karakaari 7
02610 Espoo
Finland

Tel. +358 (0) 10 44 88 000

CID:

nokia.com



About Nokia

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.